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A Letter from Mr. William Musgrave Fellow of New College Oxon: and one of the Secretaries of the Royal Society, to the Learned Dr. Martin Lister, wherein He endeavors to prove that the Laeteals frequently convey Liquors that are not White.

Honored Sir,

THAT considerable Experiment of Yours, made for altering the colour of the *Chyle* in the *Laeteal Veins*, (which I have found to succeed, by injecting a pint of a Decoction of *Stone-blew*, into one of the *Intestina tenuia* of a Dog, kept fasting 36 hours &c.) does not only claim my assent to the Conclusion you draw from it, viz. That a color'd Liquor may find admittance into the *Laeteal Vessels*; but also has (in part) been the occasion of my inclining to an Opinion, That the *Laeteals* frequently convey liquors which are not *White*: In Confirmation of which Proposition, I must beg leave First to give you an account of some *Experiments* I have lately made, relating to this matter; and secondly to offer at some Deductions from them: The *Experiments* are of three kinds;

I.

I kept 2 *Dogs* fasting, one 48 hours, the other 3 daies, and then open'd them; in both a considerable number (above 20, where fewest) of the *Laeteals* appeared *Pelucid*, like *Lymphatics*; only not so full and turgid, as those under the *iver* are generally, or as the *Laeteals* themselves are sometimes, seen: I cut several of them

in each Dissection, and immediatly a *Transparent liquor* flowed out of the Orifice.

2.

A *Dog*, which had neither eaten, nor drank, in three daies. was suffer'd to lapp a quart of common water; an hour after which, he was open'd; the *Lacteals* shew'd themselves in a great number (perhaps above 60,) all *limpid*, from the liquor contain'd in them, as in the former *Experiments*: part of the water was suppos'd to be st^{ill} in the *stomach* and *small Guts*; for the quantity of water seen there, was far greater, then that in the *primæ viæ* of either of the *Dogs* kill'd fasting.

This *Experiment* was repeated with very little alteration in the trial, and the same success as before.

3.

Another *Dog*, after three daies fasting, had a peice of fat Meat given him; an hour and half after which, he lapt (about) a Quart of common Water, and half an hour after this, was open'd: I first tied the *Ductus Thoracicus*; then examin'd the *Lacteals*; which I saw in as plentiful a number, and as full as (perhaps) they were ever seen in this *Species* of *Animals*: eight, or ten, of them at the first opening of the *Dog*, appear'd perfectly white; very many of a faint diluted white; but most of them were Pellucid; especially at the latter end of the Dissection; by which time, several, which at first were either of a lively, or of a fading White, were now grown transparent: that I might satisfy my self as to this difference in the colour of these vessels, I open'd the *Intestinum Jejunum*, and *Ileon*, in several places; and found the water was got as far as the *Cecum*; and had carried down diverse little parcels of the meat with it;

by

by which means the liquor seen in the *Lacteals*, at the first view of them, was either of a perfect, or of a diluted white, or else pellucid, according to the mixture of the meat with the water in the guts.

I ordered about 3 pints of broth to be given a *Dog*, which had been kept fasting 24 hours, and opening him 4 hours after this, I observed the *lacteals*, beginning at the *Duodenum*, (with which the other small guts, and stomach) was very much distended with the matter of the last meat: all the *Lacteals*, that I saw at first, were of a perfect white colour; several of which I prest between my fingers, drawing them from the circumference toward the Center of the *Mesentery*, by which means I found, that the *Chyle*, contain'd in these *Vessels*, appear'd White, when it ran in a shallow stream, as well as when it fill'd the *Lacteals*: Viewing the rest of these *Vessels* along toward the *Cæcum*, I observ'd, that, near the middle of the *Intestinum Ileon*, they began to be of a more diluted white, and a little farther, they were really pellucid, and as turgid, to appearance as those that were White; after which turning back again toward the stomach, I saw the same *Vessels* (I think) in as great numbers as at first (perhaps above 80) but the colour of most of them was chang'd, for they were all now pellucid: some 3, or 4 which I at first cut asunder for my better enquiry into the *white Chyle* contain'd in them at that time, being limpid together with the rest. The same thing succeeded in a *Dog* kept fasting 2 daies, and then open'd 3 hours after he had lapt 3 pints of Milk, part of which was seen in the stomach of the *Dog*: about 15 of the *Lacteals*, arising from the *Duodenum*, were white; above 100, proceeding from the *Intestinum Jejunum*, and *Ileon*, were, more, or less, transparent; as also were those of the *Duodenum* at the latter end of the operation.

2. This being the Relation of matter of Fact, let us
now,

now, in the second place, examine, what is the Consequence, what the Effects, of all this slaughter.

1. The *Experiments* of the first kind do sufficiently prove, that the *Lacteals* convey not only *Chyle* (which results from aliments lately taken into the stomach, and may be call'd *Liquor Novitius*,) but also another humor separated (as is most probable) from the blood, and now returning to it again; which (by means of the aforesaid *Experiments*,) may be seen purely by it self, without any mixture of *Chyle* with it.

As to the place, where this *liquor Refluis* (for so we will hereafter term it) parts from the blood; particularly whether it be a *Lympha*, properly so call'd, arising in the musculse Veines of the *Intestines*? Or whether it be a liquor emptied into the hollow of the *Stomach*, and *Intestines*, from the *Pancreas*, *Glandularum plexus Fragiformes*, and perhaps the *Liver*; or thirdly whether it proceeds partly the former, partly the latter, way; is a Question not easily determin'd. *Caspar Bartholin*, who looks on himself (and it may be justly enough) as the first observer of the *Lacteals* appearing sometimes limpid, like *Lymphatics*, has these words in favor of the former of those Opinions; having spoken before of the *glandulose Tunics* of the *Intestines*. He saies [*si verum sit, quod magnam veri speciem habet, Lymphatica ab aliis partibus non glandulosis oriri, has (scilicet lacteas) ab Intestinalis Lympham superfluum revocare dicam.*] *Diaphragmatis structura* pag. 95. But as far as I can judge at present, it seems not unreasonable to derive at least part of this Liquor from the hollow of the *Intestines*; if we consider, that the *Pancreas*, and *Glandularum Plexus Fragiformes*, (not to mention the *Liver*) do daily discharge a liquor into the *Intestines*; which (considering that *Dogs*, after three daies fasting, will, as I have often observ'd, have very hard *faces* in their *Intestina*
Recta)

Reſta) we cannot well diſpoſe of any other way, then by ſaying, it reenters the blood by the *Laſteals*, and is that very liquor, which conduces to the making ſome of them appear transparent after ſo long a faſt.

2 It ſeems probable, from the ſame forementioned *Experiments* of the firſt kind, That the *Laſteals* are very ſeldom, or never, all empty at the ſame time; for tho the *Chyle* flows only in certain *Tides*, or *Flaſhes*, *proratione Ingeſtorum*; yet the *Liquor Reſſuus*, running in a more conſtant ſtream, does, when there is no Flaſh of *Chyle* going in, keep the *Laſteals* from being abſolutely empty.

3. But, to come nearer to my purpoſe, tis farther evident from the ſame *Experiments*, that this *Liquor Reſſuus* is, in its own nature, *transparent*; and paſſes ſuch thro the *Laſteals*, after long faſting, when no *Chyle* is mixt with it; which is no inconfiderable ſtep to the making out of my Propoſition, if we recount how long, and how often, very many *Quadrupeds*, beſide Men, do faſt from all ſorts of aliment; during which time, after the *Chyle* of the laſt Meat, or time of drinking, is all mixt with the blood, we may ſuppoſe that this pellucid *Liquor Reſſuus*, goes alone into the *Laſteals*.

4. The *Experiments* both of the ſecond, and third kinds, ſeem to intimate, that a great part of the *Chyle* it ſelf is, in its journey thro the *Laſteals*, altogether *Limpid*: againſt which if it be objected, that ſome of the *Laſteals* were, in a like manner, pellucid, in all the *Experiments* of all the three kinds, and therefore it does not appear but that they may be fill'd with a *Liquor Reſſuus* in the 2 laſt *caſes*, as well as for certain) they were in the firſt *Caſe*; to this Objection, beſide what may be answered from the extraordinary number, and fulneſs of the *limpid laſteals* in the 2 laſt kinds of *Experiments*, comparing theſe *Veſſels* with thoſe of the ſame

same sort seen in the first kind (which comparative excess cannot be imputed to any cause so reasonably, as to the matter given the *Dogs* a little before the Dissections of the 2 last kinds ;) beside this I say, it may farther be replied, that in all the Instances of the 2d and 3d *Cases*, a considerable quantity of aliment was taken in by each *Dog*, not long before his Death ; That some of this matter was seen in the *primæ viæ* of every one of them when dead ; (an argument it was not all Distributed ;) That there is no way, certainly known, by which liquors are discharged the *primæ viæ*, in this *Species* of *Animals*, beside *Vomiting*, *Seige*, and by the *Lacteals* ; and that ; seeing neither of the 2 former took place, it may not be unreasonable to suppose, That part of this matter was, at each dissection, in its way thro the *Lacteals* to the blood, all the operations being at such distances from the time of the matter's being taken in, at which most liquid aliments are observed to swell up the *Lacteals*.

But farther, whoever shall insist upon this Argument, if he derives his *liquor Refluus* from the Musculose Tunics of the *Intestines*, is liable to the objection before mentioned against that opinion ; if from the *Pancreas*, *Glandularum Plexus Fragiformes*, and *Liver*, will find it no easy thing to account, why *this liquor* should be admitted the *Lacteals*, and the water (taken *in specie* in the *Experiments* of the 2d kind ; as also in the first Instance of the 3d kind ; and included in the broth given in the second instance of the third kind) should be excluded ; altho in some of these Instances it was seen to have almost reacht the *Cæcum* : especially si ce it is sufficiently prov'd, That *Decoctions* of *Indigo* and *Stoneblew* (of which *Decoctions* far the greatest part is Water) have found the way into the *Lacteals*.

Now if it be not too precarious to suppose, That the Liquor, seen in the *Pellucid lacteals* of the 2 last kinds of

Experiments, did, in a great measure (for I by no means exclude the *liquor Refluxus*) consist of the matter lately taken in before the *Dogs* were opened; we may with good reason imagine, That water, drunk on an empty Stomach, (as it was in the second Case) by several other *Quadrupeds*, and *Men*, as well as *Dogs*, will pass the *Lacteals*, not under a white colour, but rather *Pellucid*; and these Cases are not uncommon amongst us; particularly this seems to hold true in those, who drink great quantities of *Diuretic Mineral Waters*, in the morning, fasting; of which suppose any person takes and Evacuates, 3 Quarts, by Urine, in the forenoon; and, with his dinner, and in the afternoon, drinks 3 Pints of Bear, or the like (allowing that all the *Chyle* produced from what he takes in at dinner, and in the afternoon, amounts to 2 Quarts, and that these 2 Quarts of *Chyle* are perfectly White; which in all probability is not true; yet, I say, according to this favourable account) three Pints of *Pellucid*, for 2 of *white Chyle*, will pass the *Lacteals* in this person, in 24 hours. And what is here said of Water, is not unlikely to be true (*mutatis mutandis*) of several other liquors, as *Wine*, *Bear*, &c. at least so far as that they may not pass white thro the *Lacteals*, which is sufficient for my purpose. Again, if this principle be true, the third kind of these *Experiments* will go yet farther and argue, That the whole quantity of *Chyle*, arising from some sorts of Meat, and Drink, taken either at, or near, the same time; or from some sorts of Meat taken alone; is not alwaies white; for the *Lacteals*, which appear'd perfectly white in the several Instances of the third kind, were far inferior in number to those that were *Pellucid* in the same Dissections: But the proportion of the White, to the Diluted, and the *Pellucid*, *Chyle*, depends upon so very many Circumstances, (as the quality of both meats, and drinks; the distance between the time of their being taken; and the proportion

tion of one to the other) that it seems almost impossible to determine it.

From the Premises it appears, there is some reason to induce us to think, that the *Lacteals* frequently convey Liquors, which are not white ; and that *Chyle* may (not improperly) be divided into three sorts at least, viz. *White*, *Pellucid*, and *Intermediate* to these ; contrary to the opinion of those *Anatomists*, who thought it to be alwaies white, as that word is contradictingisht to [*Pellucid*] ; altho by [*Chyle*] They understood (as I likewise do) the Effect of Drink, as well as Meat, Concocted.

This (Sir !) is the summ of what I shall trouble you with at present, concerning this subject ; an account of which I here send you, having been assur'd, it will meet with a welcome at your hands ; and indeed the whole being a Building on your foundation , the right and Title of it does of Consequence belong to You : But that which gives the greatest encouragement to the writing of this Letter, is, that I know I write to one, who has Candor to excuse, as well as Judgment to discover, my Errors ; to the former of which I must of necessity be oblig'd, and am not averse to the latter ; but shall rather be glad, if I may know your sentiments concerning the matter in hand, which way soever they shall tend, whether to a Confirmation, or a Confutation of this Opinion.